Prepared for:

Freeport-McMoRan
Chino Mines Company
Hurley, New Mexico

Completion Report

Interim Remedial Action
Star Rock Stockpile
Hanover and Whitewater Creeks Investigation Unit

Prepared by:

Golder Associates
Silver City, New Mexico

April 8, 2011

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1.0 INTRODUCTION

This completion report summarizes the remediation of the Star Rock Stockpile (the stockpile) site within the Hanover and Whitewater Creeks Investigation Unit (HWCIU) under an Interim Remedial Action (IRA) pursuant to the Administrative Order on Consent (AOC) for Freeport-McMoRan Chino Mines Company (Chino). This work was performed in accordance with the IRA Plan described in letters from Chino to the New Mexico Environment Department (NMED) dated April 27, 1998 and May 12, 1998.

Chino regraded and covered the stockpile material during construction of Reservoir 17 in 1998. NMED approved the interim action in a letter dated May 22, 1998.

The stockpile material was characterized in 1998 as part of the Phase 2 Comprehensive Groundwater Characterization Study (CGCS; Chino, 1998). This report describes that previous characterization of the stockpile material and the recent characterization of the cover material and vegetative cover. A monitoring plan is also proposed to detect potential erosion, observe continued vegetation growth, and protect water quality.

This completion report is organized into the following sections:

- Section 2 states the purposes of the IRA.
- Section 3 contains the site description and a brief history.
- Section 4 describes the characterization of the stockpile material and the regrading and covering performed in 1998.
- Section 5 describes the post-remediation characterization of vegetation and soil-cover materials.
- Section 6 provides a post-remediation monitoring plan for the site.
- Section 7 presents a summary.
- Section 8 contains references cited in this report.

2.0 INTERIM ACTION OBJECTIVES AND SCOPE OF WORK

The primary objective of the IRA was to reduce potential mass-loading of metals and acidity from source materials to surface water in accordance with New Mexico Water Quality Control Commission (WQCC) requirements under Regulation 1203. The IRA was conducted in accordance with the work plan Chino presented in a letter to NMED dated April 27, 1998, with additional information in a letter dated May 12, 1998, as a short- to intermediate-term solution to reduce migration of potentially affected runoff from entering Whitewater Creek. The IRA work plan was approved by NMED in a letter to Chino dated May 22, 1998.

Subsequent to the regrading and covering of the stockpile slopes, vegetation has colonized the cover material and erosion has stabilized, indicating the soil cover is capable of recruiting and maintaining a self-sustaining ecosystem suitable for wildlife habitat and/or grazing. The soil cover and vegetation was recently investigated to determine whether the interim action is consistent with long-term remediation goals. Regrading and covering the stockpile slopes, controlling surface-water runon, and volunteer vegetation growing on the cover material have effectively reduced mass-loading from source materials and controlled potentially poor-quality discharges to surface water or groundwater resulting from past mining activities at the site.

The remedial action implemented at the Star Rock Stockpile is consistent with the following long-term remedial objectives:

- Reducing future releases to surface water, groundwater, and soil or sediment;
- Limiting direct exposure to the stockpile materials;
- Achieving post-mining land use;
- Preventing erosion; and
- Ensuring physical stability and site safety.

This interim action is also consistent with Chino's long-term strategy for closure/closeout and meets standards prescribed in the AOC agreement. It also conforms with the New Mexico Mining Act guidance pertaining to returning the disturbed area to a post-mining beneficial use, such as wildlife habitat or grazing.

3.0 BACKGROUND AND HISTORY

The Star Rock Stockpile is located on a hillside north of Whitewater Creek. It is on Chino property northeast of the town of Bayard, and west of the South Stockpile (Figure 1).

The Star Shaft is a vertical shaft accessing the northern underground mine workings of the historical Groundhog Mine. The Star Rock Stockpile is adjacent to, and north of Reservoir 17 and near several buildings used for mine operations (Figure 2). The stockpile material was generated from the early development of the underground workings and stockpiled in the vicinity of the shaft, and thus contains near surface non-acid generating rock material.

The bedrock geology in the area of the stockpile is predominately granodiorite. The stockpile footprint prior to remediation is shown in Figure 2. A portion of the prior stockpile surface is currently used by Chino for storage, haul truck traffic, and a rail spur used for operations at the Ivanhoe Concentrator. The southern slope of the stockpile was regraded and covered in 1998 during construction of Reservoir 17. Reservoir 17 is a flood-control structure constructed as an NMED requirement to renew Discharge Permit 526 (DP-526) at that time. During construction, some sediments in Whitewater Creek and some waste rock were removed to the West Stockpile, the slopes of the Star Rock Stockpile were regraded, and un-impacted sediments excavated from the reservoir footprint were used to cover the regraded slopes.

The stockpile material was characterized in 1998 for the Phase 2 Comprehensive Groundwater Characterization Study (CGCS; Chino, 1998). The stockpile was determined to be non-acid generating. Leach testing at that time indicated that the stockpile material did not leach concentrations of constituents in excess of WQCC standards. The Phase 2 CGCS characterization of the stockpile is summarized in Section 4.1.

The stockpile cover was not seeded, but vegetation has colonized the cover over the years, including grasses, forbs, shrubs, and trees.

4.0 STOCKPILE CHARACTERIZATION AND REMEDIATION

The Star Rock Stockpile was characterized, covered, and revegetated in 1998 as an interim remedial action under the AOC. Implementation of an IRA was accelerated to accommodate use of material excavated during construction of Reservoir 17 for a soil cover and to control erosion adjacent to the new reservoir.

Remediation objectives require reducing erosion associated with overland runoff and concentrated flows from high-intensity storm events. In addition to reducing potential mass-loading as described in Section 2.0, a secondary goal was to provide a stable surface that enhances vegetation growth and allows the establishment of a self-sustaining ecosystem. Characterization of the stockpile was performed at the same time the covering of the slopes was underway in order to assess the nature of the material before it was covered. Stockpile characterization and slope stabilization are described in the following sections.

4.1 Stockpile Material Characterization

The exposed stockpile surface was noted to be slightly mineralized, with visual observation of pyrite and iron staining (Chino, 1998). Stockpile characterization was performed by Daniel B. Stephens and Associates, Inc., in 1998. The investigation is detailed in the Phase 2 CGCS Report (Chino, 1998) and summarized in this section.

Fifteen samples were collected from test pits on the top of the stockpile in June 1998 (Figure 2). At the time of sampling, the western portion of the slope had been regraded and covered. Samples were collected from test pits excavated 1 to 2 feet into the surface of the stockpile by backhoe. The samples were composited by stockpile quadrant into four samples designated Star Rock NE, NW, SE, and SW.

The four composite samples were sent to SVL Analytical (SVL) in Kellogg, Idaho, for analysis of acid-base accounting (ABA), paste pH, total metals and general chemistry concentrations, and Synthetic Precipitation Leaching Procedure (SPLP) constituents.

The results of ABA tests are listed in Table 1. The Phase 2 CGCS classified the Star Rock Stockpile as not acid generating based on the net neutralization potential values of 392 to 630 tons of calcium carbonate per 1,000 tons. The data can also be compared to criteria in Price (1997) for acid-neutralization potential (ANP) to acid-generating potential (AGP) ratios. An ANP/AGP value of greater than 4 is classified as not acid generating. The composite samples from the stockpile had ANP/AGP values ranging from 14.8 to 202.2,

indicating they are not acid generating. This is further supported by the paste pH values of 7.5 to 7.6 standard units (su).

Total metals and SPLP results are listed in Tables 2 and 3, respectively. Total metals analysis was conducted to determine the chemical nature of the stockpile material. SPLP testing was performed to determine whether metals identified by total metals analysis had the potential to leach from the stockpile. One of the four composite samples had an elevated fluoride concentration possibly due to the high limestone content of the stockpile. Other metals were detected in the leachate, but not at elevated concentrations. The majority of concentrations were less than the analytical detection limits.

4.2 Stockpile Slope Regrading and Runon Controls

During the 1998 excavation of Reservoir 17, adjacent to the Star Rock Stockpile, sediments from Whitewater Creek were removed and hauled to the West Stockpile. Bedrock was also excavated from below the channel sediments to provide additional capacity in the reservoir. This excavated bedrock material was tested for paste pH during excavation. Bedrock material with a paste pH of 5 su or less was also placed at the West Stockpile. Excavated material with a pH of greater than 5 su was placed on the regraded Star Rock Stockpile slopes as a soil cover and allowed to revegetate by volunteer vegetation.

The area of interim remedial action is shown in Figure 2, and includes the south slopes of the stockpile that are not used in operational areas for storage, rail spurs, or haul traffic. The area was regraded to flatten the slopes to allow placement of the soil cover. Slope steepness measured in 2010 ranged from an average 2.6 horizontal to 1 vertical (2.6H:1V) on the eastern portion of the slope to 2.3H:1V on the western portion. The slope length ranges from approximately 110 to 160 feet. The slopes are slightly steeper at the toe due to a bedrock cut along the lower railroad track.

An earthen berm is located along the crest of the slope to divert surface-water runoff from the haul road and storage areas away from the slope, thereby reducing the potential for erosion of the cover material.

5.0 POST-REMEDIATION CHARACTERIZATION

In 2010, Chino and Golder inspected Star Rock Stockpile to determine the success of the volunteer vegetation on the soil cover, and the suitability of the soil cover as a long-term interim action consistent with Chino's long-term remediation goals.

5.1 Vegetation Inspection

The vegetation inspection consisted of a visual survey of the reclaimed slope to evaluate the progress of plant establishment and to determine if the vegetation is viable, self-sustaining, and capable of supporting the post-mining land use of wildlife habitat and/or grazing. During the inspection, canopy cover and shrub densities were estimated at each site and plant species were identified. Golder completed and documented the survey, which was included in the Groundhog Annual Report and is attached here as Appendix A.

The stockpile was inspected on September 30, 2010, at the end of the summer monsoon season. Originally covered in 1998, the area was not seeded, but native plants have colonized the site. The plant community is in very good condition with an estimated average canopy cover of 45% and an estimated shrub density of 350 stems per acre. A total of 18 species were identified in the plant community, including grasses, forbs, shrubs, and trees (Table 4). This indicates that the soil cover is capable of recruiting and maintaining vegetation that is viable and self sustaining.

5.2 Cover Material Characterization

The success of the vegetation on the former stockpile is an indication that the soil-cover material is performing well as a growth medium. Additional characterization of the soil-cover material was performed to measure the cover thickness and to determine if the cover material is consistent with the 1996 Mining and Minerals Division (MMD) Draft Closeout Plan guidelines (MMD, 1996).

5.2.1 Field Investigation

The December 2010 field investigation included excavating and sampling test pits, measuring slope angles, visually inspecting the cover material lithology, and inspecting the slope toe for evidence of groundwater seepage.

Three test pits were excavated in the stockpile during December 2010 to investigate the thickness of the cover and suitability of the cover material as a growth medium. Test pit locations were surveyed using a hand-held Global Positioning System unit and are shown

on Figure 2. Test pits were excavated by James Hamilton Construction Company using a trackhoe. The test pits were each excavated to a depth of 4 feet and logged in the field according to the Unified Soil Classification System (USCS). The volume and lithology of rock fragments over 2 millimeters (mm) in the soil cover was also estimated in accordance with the United States Department of Agriculture (USDA) method for classifying soils (Table 5). Detailed logs for the test pits are in Appendix B.

Samples were collected from the cover material in each test pit. Oversized materials (larger than1 inch) were excluded from the sample material. Samples were collected by hand using clean nitrile gloves for each sample. No samples were collected from the underlying stockpile materials, but the material was visually described (Appendix B). Approximately 1 gallon of material was collected from each test pit, placed in a clean plastic Ziplock bag, and labeled with the sample identification number, the date and time collected, and the sampler's initials. Samples were packaged and shipped to Energy Laboratories in Helena, Montana, for analyses.

The surface of the cover was visually inspected and described. Slope angles were measured from the crest and toe using an Abney level.

5.2.2 Laboratory Analysis

The bulk soil samples were air-dried and passed through a 2-mm sieve at the laboratory. The less than 2-mm fraction was analyzed for:

- Texture (Method ASA15-5),
- Saturation percentage (Method USDA27-A), and
- Saturated paste pH and electrical conductivity (EC; Method ASAM10-32).

The laboratory was instructed to also run ABA with sulfur forms (Modified Sobeck) if the paste pH values were less than 5 su. Laboratory data sheets are in Appendix C.

5.2.3 Result of the Cover Material Investigation

The three test pits showed a generally consistent cover thickness of 6 inches. Test pit SR-TP-1 (Figure 2) had a slightly thinner cover of approximately 4 inches. However, the cover thickness was irregular, with an undulating contact with underlying stockpile materials. The soil cover varied from 4 inches thick to 12 inches thick in all three test pits. The USCS classification of the soil-cover material is a silty clay with gravel, and the USDA classification is a loam to a sandy loam. The cover contained moderately dense roots,

which also grew into the stockpile material, indicating that plants are utilizing the stockpile material as a growth medium.

The underlying stockpile material matrix was similar in texture and color to the soil cover in test pits SR-TP-1 and SR-TP-2 (Table 5 and Figure 2), and the contact was gradational in areas, indicating some mixing of the stockpile and cover materials. Underlying stockpile material in these two pits was a loose, dry, clayey gravel with sand. Stockpile material from test pit SR-TP-1 had clasts occurring in lenses of mixed limestone/granodiorite and granodiorite with some iron oxide staining. The stockpile material from test pit SR-TP-2 had clasts of primarily limestone to 3 feet deep, and mixed with granodiorite below 3 feet. The soil cover and underlying stockpile material reacted strongly with hydrochloric acid, indicating the presence of calcium carbonate in the soil and stockpile matrix. No sulfide mineralization was observed.

Test pit SR-TP-3, on the western end of the stockpile (Figure 2), had similar waste rock (clayey gravel with sand), but was slightly cemented and moist. Clasts were primarily limestone with minor granodiorite and shale. The soil cover and underlying stockpile material reacted strongly with hydrochloric acid, indicating the presence of calcium carbonate in the soil and stockpile matrix. No sulfide mineralization was observed.

Over the surface of the stockpile, coarse rock fragments were concentrated on the top of the cover by settling and deflation over time, creating a rock armor. The angular rock fragments ranged from gravel to occasional fragments larger than 1 foot. The lithology of the rock fragments was primarily granodiorite with some porphyry stock. Scattered sandstone fragments and occasional magnetite cobbles were also observed. The presence of these coarse fragments is desirable from an erosional stability perspective.

Tables 5 summarizes the description of the soil-cover samples collected from each test pit, including the percent volume of rock fragments. Table 6 lists the laboratory results for texture, saturated paste pH and EC, and saturation percentage for each sample. Based on the MMD Draft Closeout Plan guidelines (MMD, 1996), the results indicate that the soil-cover material is suitable for use as a growth medium.

The lack of sulfide mineralization and paste pH results of 7.2 to 7.3 demonstrate that the soil-cover material has not generated acidity even though it has been exposed at the surface for over 12 years. Similarly, the underlying stockpile material has paste pH values of 7.5 to 7.6 su, and is not acid generating. The well-established, colonized vegetation and presence of roots in the cover and stockpile materials demonstrate that the cover material and the underlying stockpile material are supporting plant growth.

Slope steepness ranges from an average 2.6H:1V on eastern portion of the slope to 2.3H:1V on the western portion. The slope length ranges from 110 to 160 feet. The bedrock outcrop at the toe shows cover material over the bedrock, with no exposed stockpile material. No evidence of seepage was seen at the soil-cover/bedrock interface.

6.0 POST-REMEDIATION MONITORING

This section presents the post-remediation monitoring plan for Star Rock Stockpile. The plan includes erosion and vegetation monitoring of the soil cover. The site will remain under the oversight of the Chino AOC at least until the Record of Decision for the HWCIU has been approved by NMED. Monitoring may then be included as part of the long-term closure actions for Chino under DP-1340. Surface-water monitoring is not proposed for this facility because the amount of runoff from the small area would be impractical to capture and sample.

Vegetation and erosion will be monitored until a self-sustaining vegetated cover is established for grazing or wildlife habitat post-mining land use. The stockpile is in proximity to operational areas (roads and active pipelines), and could be used again for operations, but will be monitored until that time as a closed facility.

The area will be monitored as follows: The revegetated soil cover and surface-water controls will be visually monitored for erosion and vegetation success annually for 4 years. The vegetation survey will present the data in a format comparable to the Vegetation Success Standards and Success Monitoring Section of Appendix C in the MMD revision 01-1 To Permit GR000RE, including canopy cover, shrub density, and plant diversity. Results of the vegetation survey will be submitted as part of the Groundhog Mine Site annual report. Surface-water controls and erosion will be visually observed quarterly until vegetation surveys demonstrate that the site is stable.

7.0 SUMMARY

The Star Rock Stockpile was remediated with a soil cover that supports vegetation. The IRA was conducted in accordance with the NMED-approved interim action as documented in the administrative record as described in Section 1.0.

Stockpile material was regraded and covered on the southern slopes of the stockpile on the hillside above Whitewater Creek in 1998, during construction of Reservoir 17. Cover material was excavated from the footprint of Reservoir 17, and placed back on the regraded stockpile if the pH was greater than 5 su. A surface-water control berm was built at the crest to prevent surface-water runon, thereby reducing the potential for erosion on the covered slope. The soil cover was subsequently colonized by natural vegetation and is now supporting a diverse plant community.

Results of the field investigation of the soil cover indicate that it is approximately 6 inches thick and mixed with the underlying stockpile materials to some degree. The stockpile material is primarily limestone and mixed limestone/granodiorite. The soil-cover and stockpile material both react with hydrochloric acid, indicating the presence of calcium carbonate. The roots from the vegetation in the soil cover extend into the stockpile material. The well-established, colonized vegetation and presence of roots in the cover and stockpile materials demonstrate that the cover material and the underlying stockpile material are supporting plant growth.

Results of the field investigation and laboratory analyses indicate that the soil cover and underlying stockpile material are providing a suitable long-term growth medium. The coarse texture of the soil cover at the surface reduces erosion, and no seepage has been observed at the toe of the stockpile slope.

Vegetation is established, erosion and sedimentation are reduced, and the land can be designated for a variety of uses, in line with success criteria of the Closure/Closeout Plan for Chino.

8.0 REFERENCES

Chino Mines Company (Chino), 1998. Comprehensive Groundwater Characterization Study Phase 2 Report. Hurley, New Mexico. Prepared for New Mexico Environment Department, by Daniel B. Stephens and Associates. August 1998.

Lasky, Samuel G, 1936. Geology and Ore Deposit of the Bayard Area, Central Mining District, New Mexico. State Bureau of Mines and Mineral Resources, New Mexico School of Mines, 1936.

Mining and Minerals Division (MMD), 1996. *Draft Closeout Plan Guidelines for Existing Mines*. Mining Act Reclamation Bureau, Santa Fe, NM. April 30, 1996.

Price, William A, 1997. Draft, *Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Minesites in British Columbia*. Reclamation Section, Energy and Minerals Division, Ministry of Employment and Investment, British Columbia. April 1997.

TABLES

Table 1
Acid-Base Accounting Results for Composited Stockpile Samples
June 1998

		ABA Results				Sulfur				
Sample ID	Paste pH	Net Neutralizing Potential	ANP/AGP	AGP	ANP	Unidentifiable	Sulfide	Sulfate	Total	Material Classification
	s.u.	$tCaCO_3$/ton	$tCaCO_3$/ton	$tCaCO_3$/ton	$tCaCO_3$/ton	%	%	%	%	
Star Rock NE	7.60	392	44.26	9.06	401	0.04	0.29	0.16	0.49	Not Acid Generating
Star Rock NW	7.59	523	14.84	37.8	561	0.04	1.21	0.23	1.48	Not Acid Generating
Star Rock SE	7.60	403	144.48	2.81	406	0.02	0.09	0.18	0.29	Not Acid Generating
Star Rock SW	7.45	630	202.24	3.13	633	<0.01	0.1	0.04	0.15	Not Acid Generating

Source: Chino, 1998

Notes: ANP = acid-neutralizing potential
AGP = acid-generating potential - calculated based on sulfide sulfur
s.u. = standard units
tCaCO3/ton = tons calcium carbonate per 1,000 tons
< = concentration is less than the analytical detection limit

Table 2
Total Metals Results
For Composited Stockpile Samples
June 1998

	Star Rock NE	Star Rock NW	Star Rock SE	Star Rock SW
Calcium	162,000	196,000	138,000	238,000
Chloride	5.4	5.5	4.6	4.3
Fluoride	1.3	1.5	<1.0	2.5
Potassium	1,150	932	1,080	830
Magnesium	11,800	6,840	9,350	6,980
Sodium	46.2	55.6	38.8	40.9
Sulfate	1,400	2,680	1,730	1,960
Silver	2.8	1.7	1.2	0.85
Aluminum	9,560	5,900	8,760	5,330
Antimony	6.7	<6.2	<6.2	<6.2
Arsenic	5.8	5.1	6.8	6.2
Boron	<4.7	<4.7	<4.7	<4.7
Barium	42.0	44.6	77.9	17.0
Beryllium	1.1	0.49	0.71	0.31
Cadmium	19.6	17.7	13.2	8.8
Cobalt	7.1	3.9	6.3	4.9
Chromium	18.2	12.5	18.1	16.2
Copper	187	247	269	98.7
Iron	10,000	13,400	15,300	9,020
Mercury	<0.05	<0.05	<0.05	<0.05
Manganese	3,510	3,300	3,020	1,090
Molybdenum	3.9	<1.7	<1.7	1.7
Nickel	7.7	<6.3	6.7	13.0
Lead	1,480	2,170	613	890
Selenium	<1.0	<1.0	<0.10	<1.0
Thallium	<0.12	<0.12	<1.2	<1.2
Vanadium	14.7	6.5	11.2	10.4
Zinc	7,550	6,450	5,200	3,320

Source: Chino, 1998

Notes: All concentrations in milligrams per kilogram (mg/kg)
< = concentration is less than the analytical detection limit

SPLP Results for Composited Stockpile Samples
June 1998

	Star Rock NE	Star Rock NW	Star Rock SE	Star Rock SW
Calcium	33.4	47.7	38	27.8
Chloride	0.62	0.52	0.51	0.44
Fluoride	0.56	0.79	0.35	1.95
Potassium	1.99	1.67	2.15	1.94
Magnesium	1.63	1.91	2.08	0.935
Sodium	0.501	0.586	0.510	0.443
Sulfate	166	172	125	111
Silver	<0.0037	<0.0037	<0.0037	<0.0037
Aluminum	0.0446	<0.0234	0.0837	0.0714
Antimony	<0.0312	<0.0312	<0.0312	<0.0312
Arsenic	<0.0009	<0.0009	<0.0009	<0.0009
Boron	0.0933	0.0513	0.0385	0.042
Barium	0.038	0.0373	0.0492	0.0231
Beryllium	<0.0006	<0.0006	<0.0006	<0.0006
Cadmium	<0.0035	<0.0035	<0.0035	<0.0035
Cobalt	<0.0059	<0.0059	<0.0059	<0.0059
Chromium	<0.0064	<0.0064	<0.0064	<0.0064
Copper	<0.002	<0.002	<0.002	<0.002
Iron	<0.0174	<0.0174	<0.0174	<0.0174
Mercury	<0.0001	<0.0001	<0.0001	<0.0001
Manganese	0.008	0.004	0.0121	<0.0025
Molybdenum	0.0123	<0.0085	<0.0085	<0.0085
Nickel	<0.0315	<0.0315	<0.0315	<0.0315
Lead	0.0025	0.0035	0.0027	0.003
Selenium	<0.0005	<0.0005	<0.0005	<0.0005
Thallium	<0.0006	<0.0006	<0.0006	<0.0006
Vanadium	<0.0033	<0.0033	<0.0033	<0.0033
Zinc	0.0072	0.0117	0.0061	0.005

Source: Chino, 1998

Notes: All concentrations are in milligrams per liter (mg/L)
< = concentration is less than the analytical detection level

Plant Species Identified on Star Rock Stockpile
September 2010

Scientific Name	Common Name
Grasses	
Aristida purpurea	Purple threeawn
Aristida schiedeana	Single-awn threeawn
Bothriochloa barbinodis	Cane bluestem
Bouteloua curtipendula	Sideoats grama
Bouteloua hirusta	Hairy grama
Schizachyrium scoparium	Little bluestem
Sporobolus cryptandrus	Sand dropseed
Forbs	
Bahia dissecta	Bahia
Chaenactis stevioides	False yarrow
Mechaeranthera canescens	Purple aster
Penstemon spp.	Penstemon
Verbascum thapsus	Common mullen
Shrubs and Trees	
Ailanthus altissima	Tree of heaven
Brickelia californica	California brickellbush
Chrysothamnus nauseosus	Rubber rabbitbush
Gutierrezia sarothrae	Broom snakeweed
Senecio douglasii	Douglas' ragwort
Ulmus pumila	Siberian elm

Table 5
Physical Descriptions of Test-Pit Soil Samples
December 2011

Sample ID	Depth (inches)	Munsell Color			Rock Fragments (% by Volume)			Lithology
		Hue	Value	Chroma	Gravel	Cobbles	Total	
SR-TP-1	0-4	5YR	4	2	30	0	30	Granodiorite
SR-TP-2	0-6	5YR	4	2	28	2	30	Granodiorite
SR-TP-3	0-6	5YR	4	2	36	4	40	Granodiorite

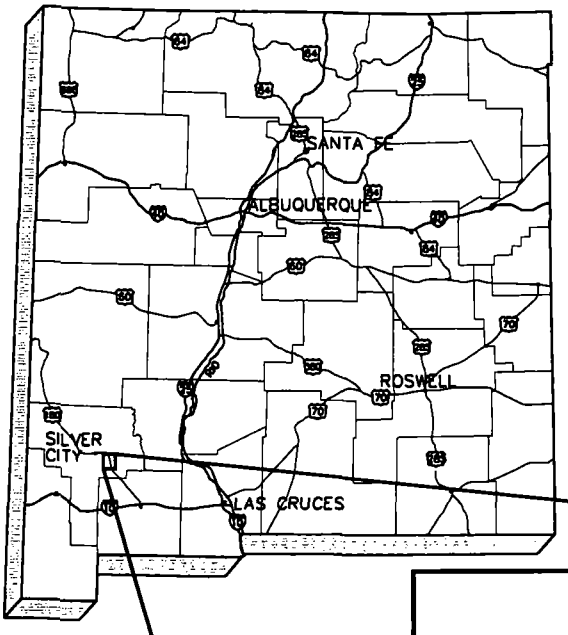
Note: Rock fragments according to Soil Survey Division Staff (1993). Gravel = 2 mm to 3 inches; cobbles = 3 to 10 inches

Table 6
Analytical Results for Test-Pit Soil Samples
December 2011

Sample ID	Depth (inches)	Mine Coordinates		Saturated Paste pH (s.u.)	Paste Extract EC (dS/cm)	Saturation Percentage (% water)	Coarse Fragments (% volume)	Particle Size Distribution (% weight)			USDA Texture
		Easting	Northing					Sand	Silt	Clay	
SR-TP-1	0-4	0771575	3630515	7.20	1.10	31.3	30	50	29	21	L
SR-TP-2	0-6	0771518	3630557	7.30	2.45	25.8	30	58	26	16	SL
SR-TP-3	0-6	0771490	3630589	7.30	1.60	26.5	40	56	28	16	SL

Notes: s.u. = standard units
EC = Electrical conductivity
dS/cm = deci-Siemens per centimeter
USDA textural class according to Soil Survey Division Staff (1993). L = loam or loamy; SL = sand or sandy

FIGURES



STATE OF NEW MEXICO
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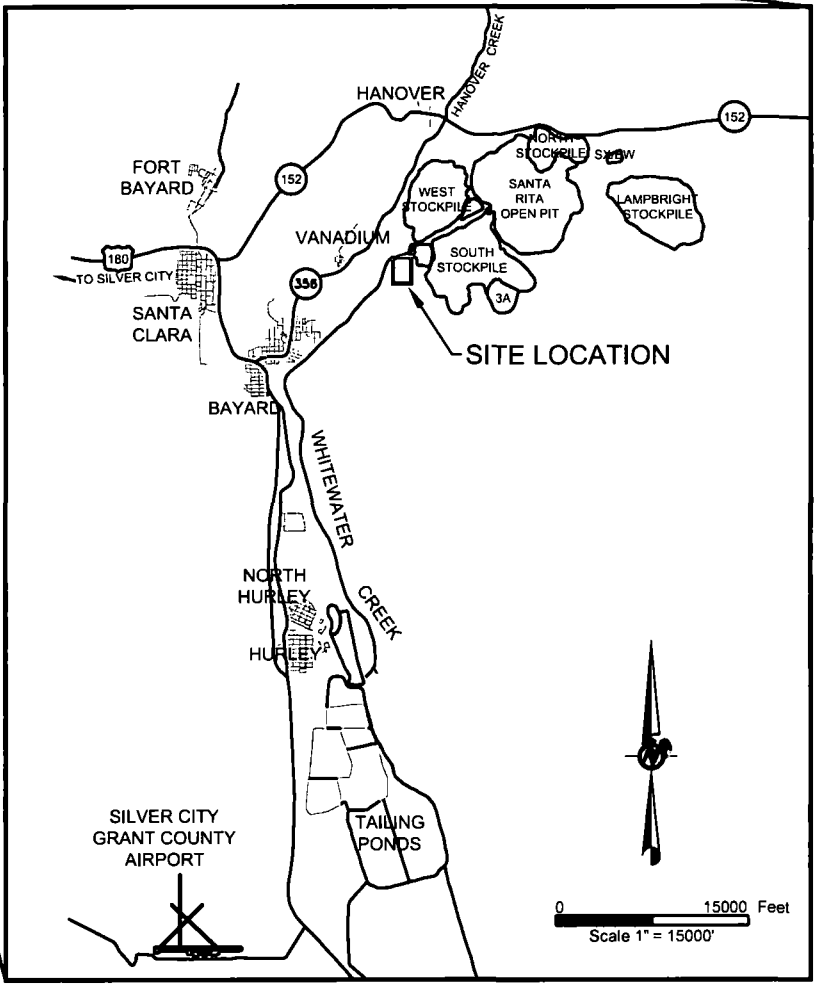

PROJECT

FREEPORT-McMoRan COPPER & GOLD
CHINO MINES COMPANY

STAR ROCK STOCKPILE
GRANT COUNTY, NEW MEXICO

TITLE

STAR ROCK STOCKPILE
SITE LOCATION

Golder Associates
Silver City, New Mexico

PROJECT No.		113-92700	FILE No.	11392700_Fig01
DESIGN	JP	02/18/11	SCALE AS SHOWN	REV. 0
CADD	CM	02/18/11		
CHECK	JP	02/18/11		
REVIEW	KJ	03/04/11		

FIGURE 1

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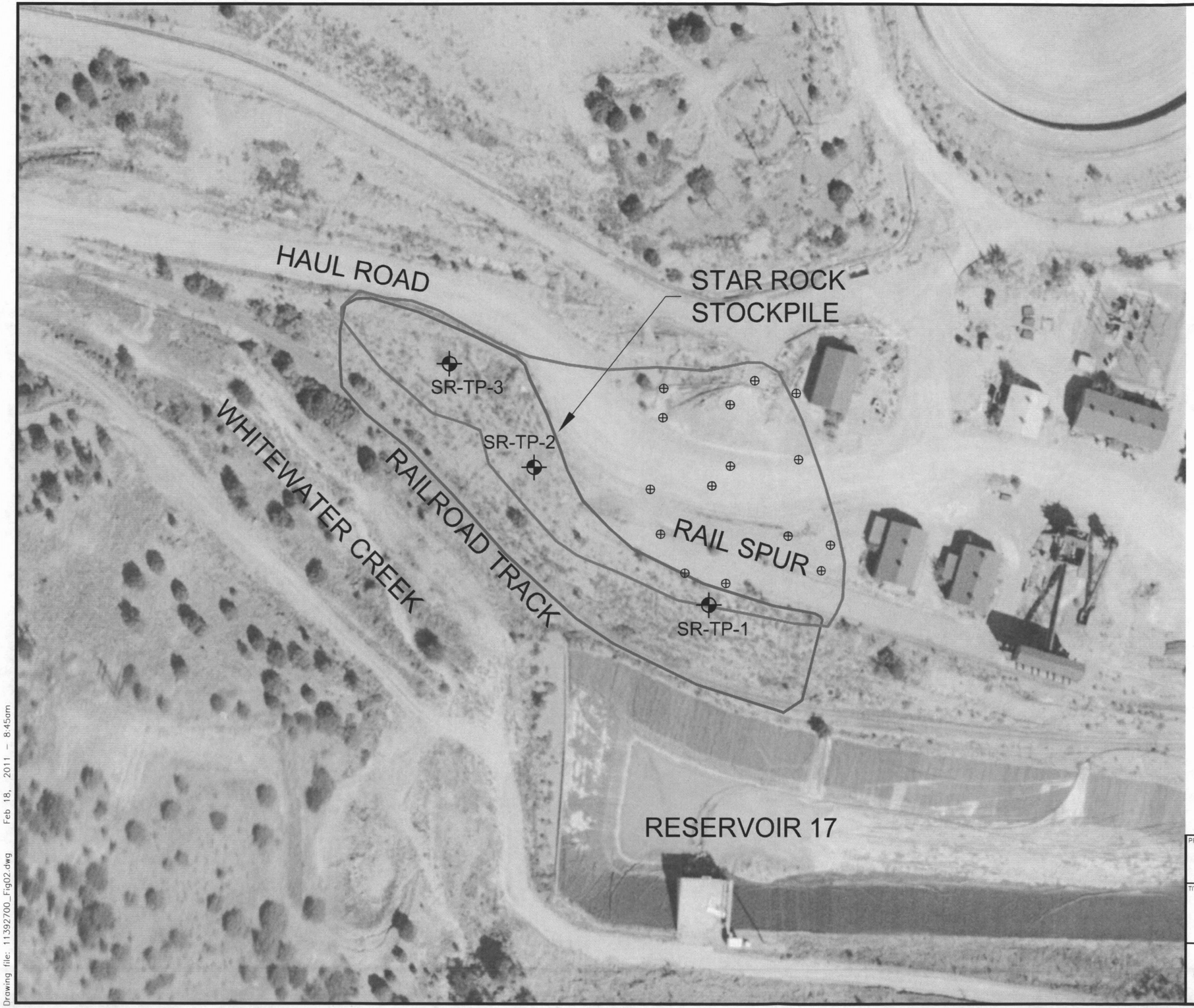


100 0 100

SCALE 1" to 100' FEET

LEGEND

- REMEDIATION AREAS
- 1998 BOUNDARY
- ⊕ 1998 TEST PIT LOCATION
- 2010 TEST PIT LOCATION

PROJECT

FREEPORT-McMoRan COPPER & GOLD
CHINO MINES COMPANY

STAR ROCK STOCKPILE
GRANT COUNTY, NEW MEXICO

TITLE

STAR ROCK STOCKPILE
SAMPLE LOCATIONS

Golder Associates
Silver City, New Mexico

PROJECT No.		113-92700	FILE No.	11392700_FIG02
DESIGN	JP	02/16/11	SCALE	SCALE REV. REV
CADD	CM	02/17/11		
CHECK	JP	02/17/11		
REVIEW	KJ	03/04/11		

FIGURE 2

Drawing file: 11392700_Fig02.dwg Feb 18, 2011 - 8:45am

APPENDIX A

VEGETATION INSPECTION
SEPTEMBER 2010

TECHNICAL MEMORANDUM

Date:	October 28, 2010	**Project No.:**	103-92704
To:	Pam Pinson	**Company:**	Freeport-McMoRan Chino Mines Company
From:	Doug Romig		
cc:	Jen Pepe Ned Hall	**Email:**	dromig@golder.com

RE: 2010 VEGETATION INSPECTION OF THE RECLAMATION AT THE GROUNDHOG MINE AND SMALL HISTORIC STOCKPILE SITES

1.0 INTRODUCTION

Freeport-McMoRan Chino Mines Company (Chino) completed reclamation of several small waste rock stockpiles in the headwaters of Whitewater Creek in 2004, and the Groundhog mine site in 2008. This work fulfilled the mitigation requirements under Interim Remedial Actions (IRAs) pursuant to the Chino Administrative Order on Consent (AOC) between Chino and the New Mexico Environment Department (NMED).

The project site is approximately 1-½ miles northeast of Bayard, New Mexico. The Groundhog mine site is located on the flanks of San Jose Mountain in a small canyon upgradient of Whitewater Creek along the Lake One haul road. Collectively known as the Small Stockpiles, the historic Osceolla, CG Bell, and Tenderfoot B sites reside along the banks and steep hillsides immediately above Whitewater Creek. The Star Rock Stockpile, located across the Whitewater Creek drainage from the Tenderfoot B, was also included in the 2010 annual inspection, although it is not specifically included in an IRA under the AOC. Figure 1 illustrates the general locations of these sites. Reclamation at these five sites included the removal of potentially-reactive stockpile materials and affected soils, closure of mine openings, site regrading, cover placement, and revegetation of the removal and borrow areas. This work was performed as part of the IRAs to reduce mass loading of metals and acidity to groundwater and surface water.

This technical memorandum documents the vegetation inspection for the Groundhog Mine and Small Stockpile reclamation sites for 2010. The sites were inspected to assess the general condition of the reclamation, estimate vegetation cover, and document the plant species that occur. The area was inspected on September 30, 2010 by Mr. Douglas Romig and Ms. Jen Pepe of Golder Associates Inc. (Golder). Also present during the inspection was Ms. Pam Pinson (Chino) and Mr. Phil Harrigan (NMED).

2.0 VEGETATION MONITORING

The vegetation inspection consisted of a foot survey of the reclaimed areas and cover borrow sites to evaluate the progress of plant establishment and determine if the vegetated cover is viable, self-sustaining and capable of supporting the post-mining land use of wildlife habitat and/or grazing. During

the inspection, canopy cover and shrub densities were estimated at each site and plant species were identified. A summary of the general conditions at each site is provided below. Photo documentation of the site conditions are provided in the photo log attached to this document. In addition, Table 1 provides a list of plant species identified during the 2009 and 2010 inspections at the Groundhog Mine and Small Stockpile sites.

2.1 Tenderfoot B

The Tenderfoot B site was hand seeded in 2004 by Chino staff and currently supports a diverse and robust plant community (Photos A through C). Average canopy cover was estimated at 75 percent. Shrubs were numerous (150 stems/acre) and at comparable densities to the adjacent native areas. In addition, numerous native forbs have become established. A total of 31 species have been identified in the reclaimed plant community (Table 1). The majority of these species were not in the reclamation seed mix and have been recruited from the native plant community adjacent to the site. A small rill was observed in the midslope position at the site, though it appeared to be inactive because perennial plants are becoming established in the small channel (Photo D).

2.2 CG Bell

The CG Bell site was also hand seeded in 2004 and vegetation establishment is discontinuous across the site (Photos E through H). Average canopy cover was estimated at 15 percent across the site and 10 species were identified in the revegetated plant community (Table 1). The site has been successful at recruiting two native shrub species from adjacent undisturbed areas. Shrub density was estimated at 150 stems/acre which is considered good at this stage of the reclamation. The site has also recruited numerous forb species but does not yet support an understory of grasses.

2.3 Osceolla

The Osceolla site extends from Whitewater Creek along the railroad tracts to an access road to the north Establishment of vegetation at the Osceolla site is inconsistent across the site. Vegetation is becoming established along the railroad tracks and in the east and west portions of the site. Estimated canopy cover in these areas was 50 percent (Photos I through K). Central sections of the site are similar to the CG Bell site where vegetation has been slow to establish (Photo L). Twelve species were identified in the revegetated plant community (Table 1), the majority of these species were recruited from adjacent undisturbed areas. Shrub density is low, estimated at 50 stems/acre.

2.4 Star Rock Stockpile

The Star Rock Stockpile site was inspected at the request of Ms. Pinson. This stockpile was characterized in the late 1990's along with the three Small Historic Stockpiles and lab analysis determined that this site did not exceed New Mexico groundwater standards unlike the other 3 historic sites. Covered in 1997, the area was not seeded, and native plants have colonized the site. The plant community is in very good condition with an estimated average canopy cover of 45% and an estimated shrub density of

350 stems/acre (Photos M and N). A total of 18 species were identified in the reclaimed plant community (Table 1).

2.5 Groundhog Mine

The Groundhog site was hydroseeded by Freeport-McMoRan Reclamation Services in 2008. Vegetation establishment at the Groundhog Mine site is progressing exceptionally well based on qualitative assessments of cover, density, and diversity. Across the reclaimed area, average canopy cover was estimated at 50 percent (Photos O through R). These cover values exceed the levels typical for the early establishment phase of reclamation in the region.

The Groundhog reclamation has excellent diversity. Eleven additional plant species were identified this year bringing the total to 46 species that have been found in the reclaimed area in the past 2 years (Table 1). While some weedy annuals were present in the reclaimed areas, they were not widespread and no noxious weeds were identified. Average shrub density was estimated around 50 stems/acre.

The vegetation in the borrow area at the Groundhog site is generally progressing well (Photos S and T). Plant density exceeds one plant per square foot and is considered appropriate for this stage in the reclamation. Small areas of localized rill erosion were observed in several locations across the borrow area. Many of these rills areas appear to initiate in undisturbed areas upgradient of the borrow site and represent the formation of a natural incipient drainage pattern along the lower slopes.

3.0 SUMMARY AND RECOMMENDATIONS

In general, revegetation efforts have been successful at the Groundhog and Small Stockpile sites, and the majority of the areas disturbed now support robust and diverse plant communities and soil surfaces are stable. Small areas at both the CG Bell and Osceolla sites appear to have had poor germination and/or seedling establishment, though they continue to recruit volunteer species from native areas. Moreover, it was noted that more species were identified at each reclaimed site relative to the 2009 inspections. This would indicate that these areas are capable of maintaining a vegetated cover that is viable and self-sustaining. Finally, the Star Rock Stockpile demonstrates that these types of sites are capable of recruiting volunteer vegetation over the long term.

Golder recommends continued annual qualitative monitoring of the vegetation progress of these areas. When all the sites have achieved cover levels that are considered adequate, Golder will complete a formal quantitative survey of the areas to demonstrate that the vegetation has achieved the success targets consistent with the Vegetation Success Standards of Appendix C in the Mining and Minerals Division revision 01-1 to Permit GR000RE.

Attachments: Table 1
Figure 1
Photo Log

TABLE 1
PLANT SPECIES IDENTIFIED ON RECLAIMED AREAS IN 2009 AND 2010 AT THE GROUNDHOG MINE AND WHITEWATER CREEK SMALL HISTORIC STOCKPILE SITES

Scientific Name	Common Name	Tenderfoot B	CG Bell	Osceolla	Star Rock	Groundhog
Grasses						
Aristida purpurea	Purple threeawn	X			X	
Aristida schiedeana	Single-awn threeawn	X	X	X	X	X
Bothriochloa barbinodis	Cane bluestem			X	X	X
Bouteloua curtipendula[1]	Sideoats grama	X			X	X
Bouteloua gracilis[1]	Blue grama	X				X
Bouteloua hirusta	Hairy grama	X			X	X
Cyperus sphaerolepis	Rusby's flatsedge	X				X
Elymus lanceolatus[1]	Thickspike wheatgrass					X
Eragrostis curvula[1]	Weeping lovegrass	X				X
Eragrostis intermedia	Plains lovegrass					X
Eragrostis spp.	Lovegrass					X
Hilaria belangeri	Curly mesquite					X
Leptochloa dubia[1]	Green sprangletop	X				X
Panicum obtusum	Vine mesquite	X				X
Schizachyrium scoparium	Little bluestem				X	
Setaria macrostachya	Plains bristlegrass	X		X		X
Sitanion hystrix[1]	Bottlebrush squirreltail					X
Sporobolus cryptandrus[1]	Sand dropseed	X		X	X	X
Forbs						
Artemisia carruthii	Sagewort	X		X		X
Astragalus nuttallii	Nuttall's milkvetch	X				X
Bahia dissecta	Bahia	X			X	X
Chaenactis stevioides	False yarrow	X	X		X	X
Conyza canadensis	Horseweed					X
Dalea candida	White prairie clover					X
Dalea leporina	Foxtail dalea	X				
Datura quercifolia	Oak-leaved thornapple			X		X
Eriogonum wrightii	Bastardsage					X
Evolvulus sericeus	Silver dwarf morning-glory					X
Monardella odoratissima	Horsemint	X				X
Gallardia pinnatifida	Red dome blanketflower					X
Gaura spp.	Beeblossom	X				X
Grindelia squarosa	Curly-cup gumweed					X
Heterotheca villosa	Hairy goldenaster		X			X
Hoffmannseggia glauca	Hog potato					X
Ipommoea cristulata	Scarlet morning glory					X
Linum lewisii[1]	Blue flax					X
Lotus wrightii	Wright's deervetch	X	X			
Mechaeranthera canescens	Purple aster	X			X	X
Melapodium leucanthum	Blackfoot					X
Melilotus officinalis	Yellow sweetclover					X
Mentzelia multiflora	Blazing star			X		
Mirabilis linearis	Narrowleaf four-o'clock					X

TABLE 1 (con't)
PLANT SPECIES IDENTIFIED ON RECLAIMED AREAS IN 2009 AND 2010 AT THE GROUNDHOG MINE AND WHITEWATER CREEK SMALL HISTORIC STOCKPILE SITES

Scientific Name	Common Name	Tenderfoot B	CG Bell	Osceolla	Star Rock	Groundhog
Forbs (con't)						
Penstemon spp.[1]	Penstemon	X			X	
Phaseolus angustissimus	Slimleaf limabean	X				
Pseudognaphalium canescens	Gray everlasting	X				
Salsola tragus	Russian thistle					X
Schoenocrambie linearfolia	Slimleaf purple mustard					X
Solanum elaeagnifolium	Silverleaf nightshade	X	X	X		X
Sphearalcea fendleri[1]	Scarlet globemallow	X		X		X
Verbascum thapsus	Common mullen	X	X		X	X
Shrubs and Trees						
Ailanthus altissima	Tree of heaven				X	
Atriplex canescens[1]	Four-wing saltbush	X				
Brickelia californica	California brickellbush	X	X	X	X	X
Chrysothamnus nauseosus	Rubber rabbitbush		X		X	
Fallugia paradoxa	Apache plume					X
Gutierrezia sarothrae	Broom snakeweed	X			X	X
Mimosa biuncifera	Mimosa	X				X
Pinus edulis	Pinyon pine		X			
Quercus emoryi	Emory oak			X		
Senecio douglasii	Douglas' ragwort	X	X	X	X	
Ulmus pumila	Siberian elm				X	

Note: 1 - Species in the reclamation seed mix

Drawing file: FigureD1.dwg Nov 01, 2010 – 11:00am

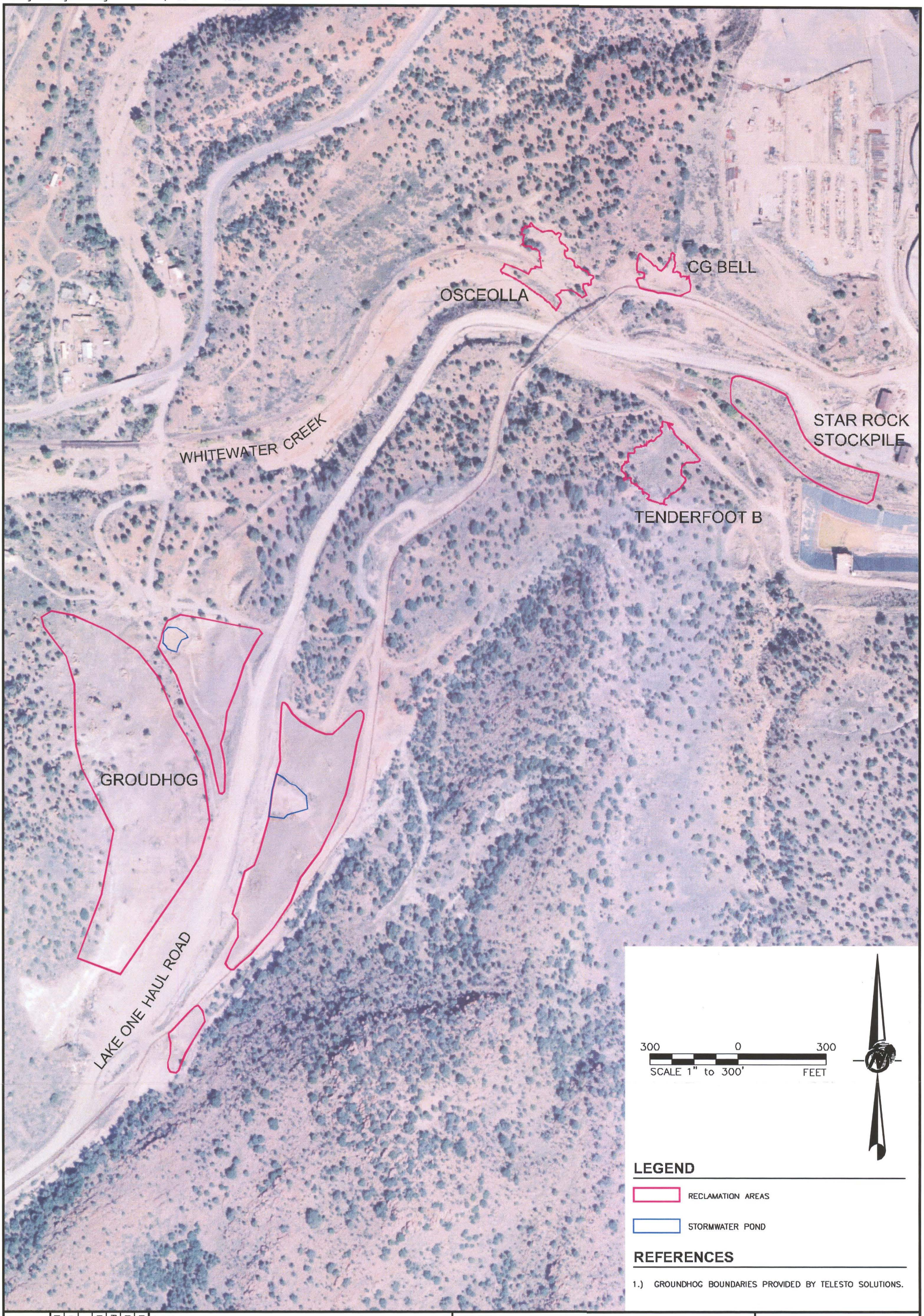


FIGURE 1

PROJECT No.	103-92704.1	
FILE No.	Figure01.dwg	
REV. 0	SCALE AS SHOWN	
DESIGN	DR	10/28/10
CADD	CM	10/28/10
CHECK	DR	10/29/10
REVIEW	DR	10/29/10

TITLE

OVERVIEW OF 2010 RECLAMATION INSPECTION SITES

PROJECT

FREEPORT-MCMORAN COPPER & GOLD
CHINO MINES COMPANY

GROUNDHOG AND WHITEWATER CREEK
SMALL STOCKPILES IRA
GRANT COUNTY, NEW MEXICO

Golder Associates
Albuquerque, NM

Attachment 1: Photo Log
Groundhog and Small Stockpile Reclamation

Photo A:
Overview of Tenderfoot B site

Photo B:
Well established reclaimed plant community on Tenderfoot B

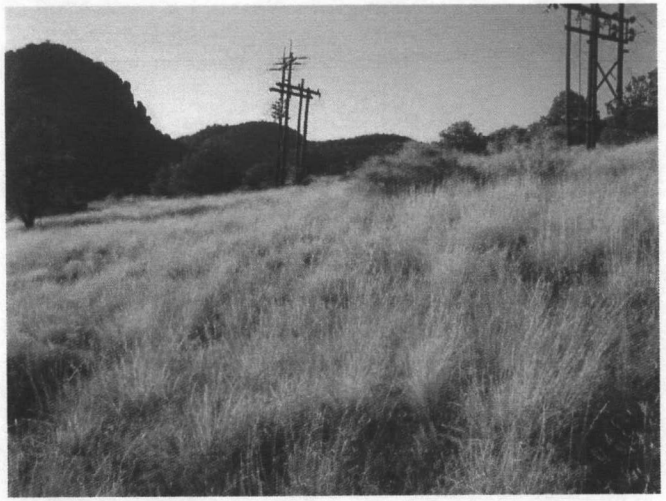


Photo C:
Excellent grass cover at the Tenderfoot B site

Photo D:
Small rill at Tenderfoot B beginning to heal (note plants establishing in the channel)

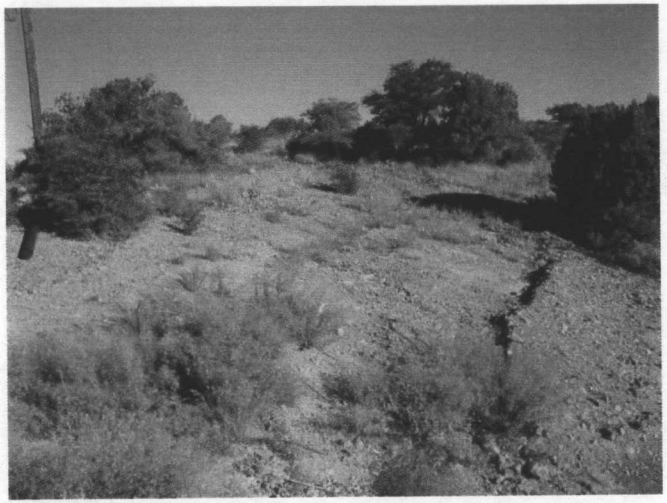


Photo E:
West side of CG Bell site

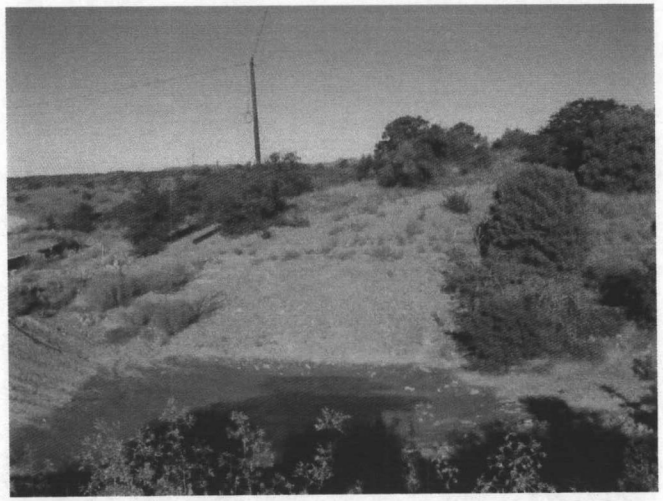


Photo F:
Overview of western slope of the CG Bell site

Photo G:
East side of CG Bell site

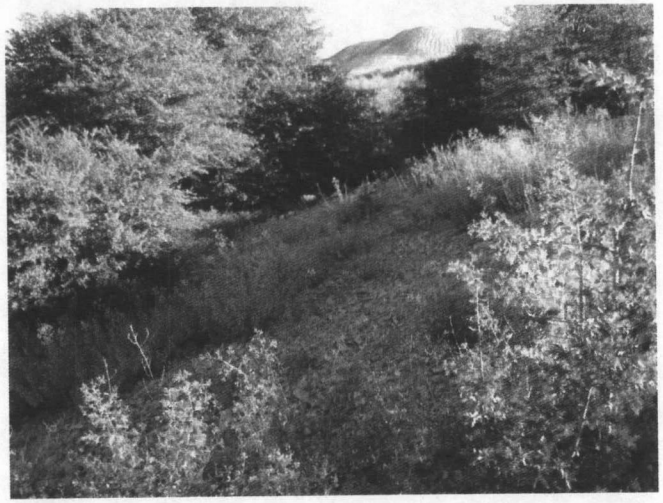


Photo H:
CG Bell site recruiting California brickellbush

Photo I:
East side of the Osceolla site

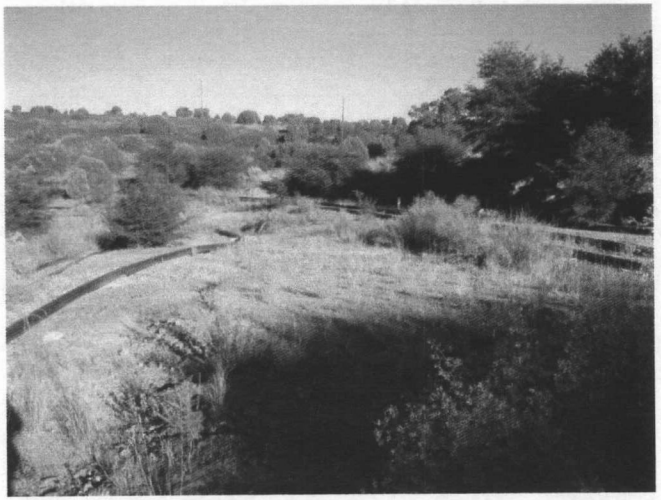


Photo J:
Lower portions of Osceolla site along railroad tracks

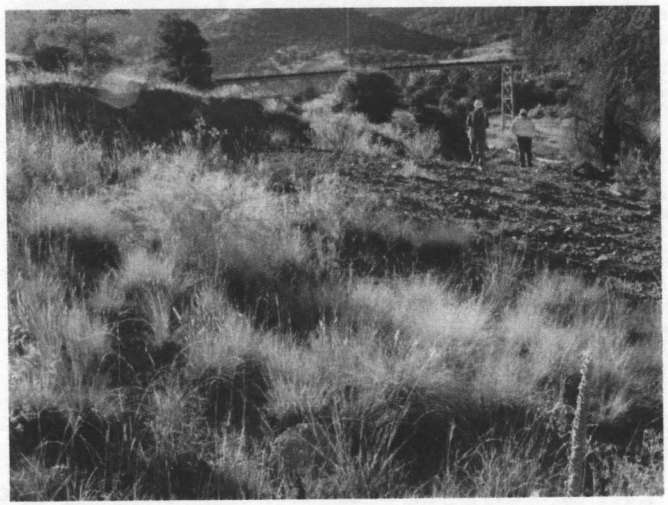


Photo K:
Western portion of Osceolla site where vegetation is well established

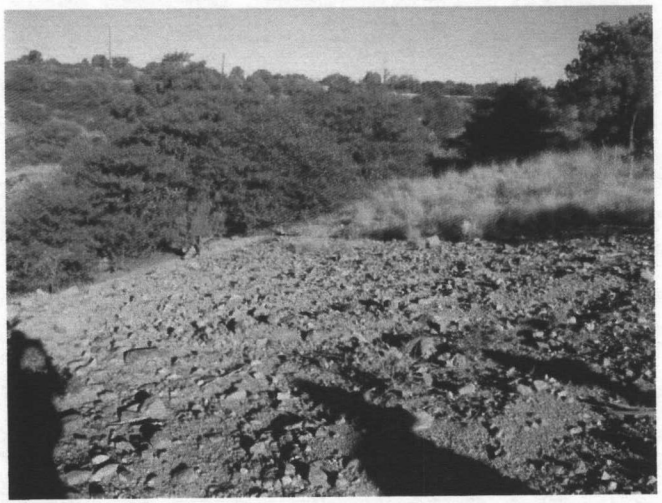


Photo L:
Central section of Osceolla site that has had poor plant establishment

Photo M:
Well established plant community at the Star Rock Stockpile

Photo N:
Good cover of California brickellbush and native grasses at the Star Rock Stockpile

Photo O:
Eastern side of Groundhog with well established vegetation

Photo P:
Overview of the Groundhog site east of the Lake One haul road

Photo Q:
West side of Groundhog in the background and the borrow area in the foreground

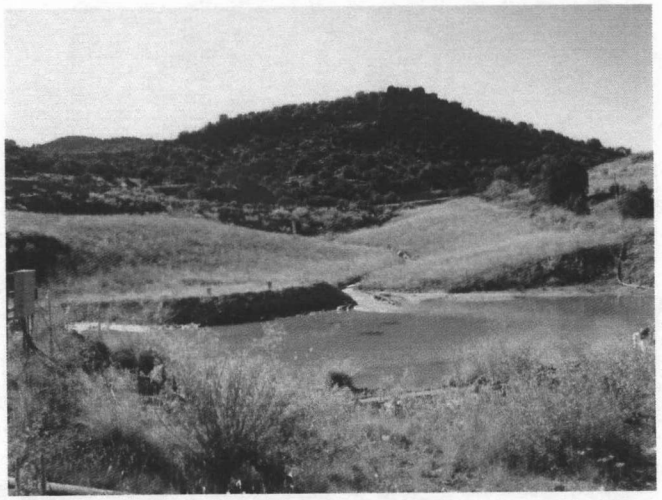


Photo R:
Looking southeast toward the Lake One haul road

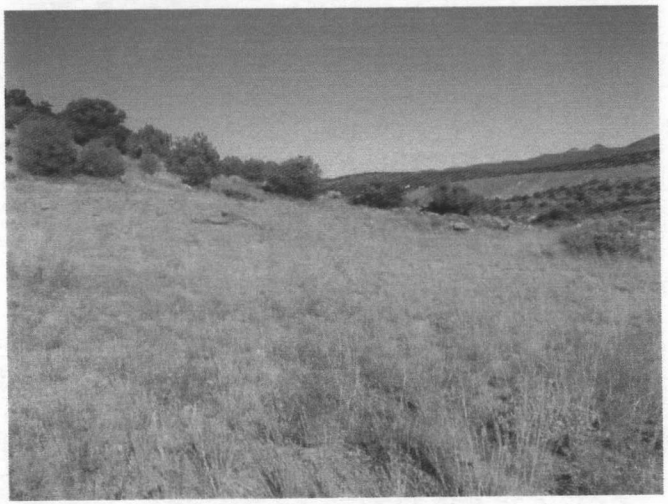


Photo S:
Groundhog borrow area reclamation

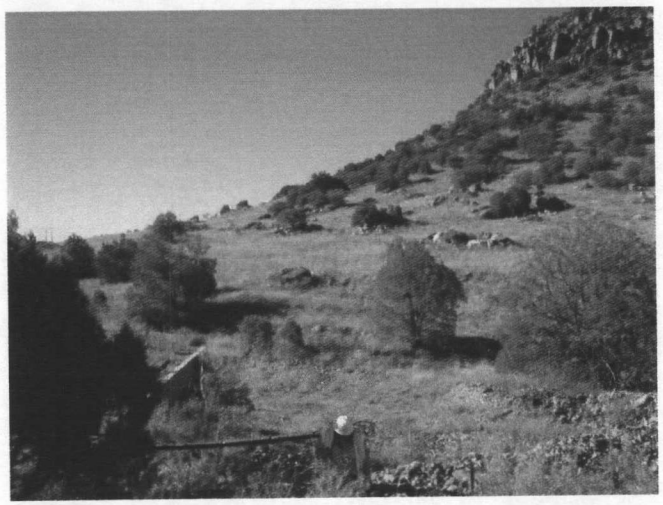


Photo T:
Overview of the Groundhog borrow area reclamation

APPENDIX B

TEST-PIT LOGS
DECEMBER 2010

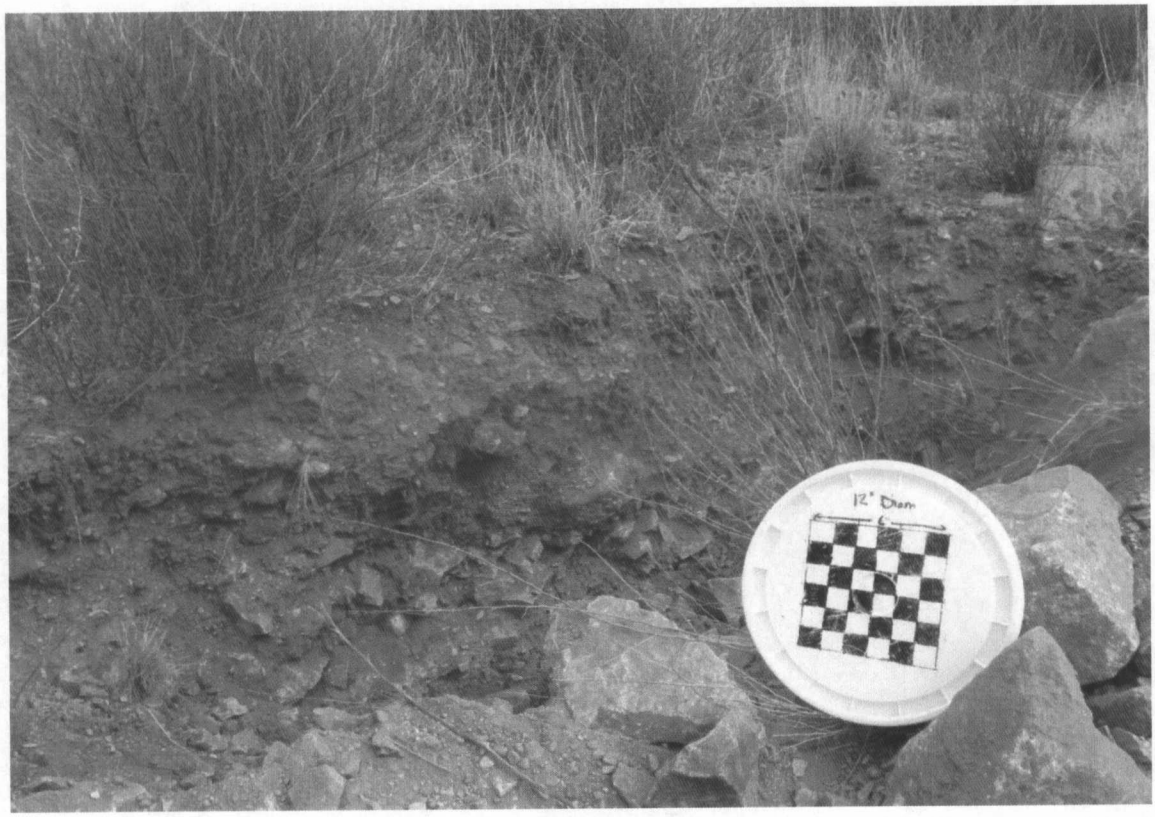
TEST PIT LOG: SR-TP-1

Client: Chino Mines Company
Project: Star Rock Stockpile
Project No.: 113-92700
Location: Chino Mine near Res 17
NAD 27: **N:** 3630515 **E:** 0771575

Date: 12/29/2010

Lithology:

Depth	*USCS*	*USDA*	*Description*
0 - 0.5 ft.	SM	Loam	Silty Sand with Gravel: 5YR 4/2 (dark reddish gray), dry, mod. plasticity, strong HCl reaction, moderately dense roots. USCS: 10% > 1.5 inch, 20% gravel, 55% Sand, 25% fines. Lithology of clasts: Granodiorite
0.5 - 4	GC		Clayey Gravel with Sand: reddish brown, dry, mod. plasticity, strong HCl reaction, some roots. USCS: 30% > 1.5 inch, 50% gravel, 35% Sand, 15% fines. Lithology of clasts: Lenses of mixed Limestone/Granodiorite, lenses of granodiorite with some iron oxide staining.



TEST PIT LOG: SR-TP-2

Client: Chino Mines Company
Project: Star Rock Stockpile
Project No.: 113-92700
Location: Chino Mine Near Res 17
NAD 27: **N:** 3630557 **E:** 0771518

Date: 12/29/2011

Lithology:

Depth	*USCS*	*USDA*	*Description*
0 - 0.5 ft.	SM	Sandy Loam	Silty Sand with Gravel: 5YR 4/2 (dark reddish gray), dry, mod. plasticity, strong HCl reaction, moderately dense roots. USCS: 10% > 1.5 inch, 20% gravel, 55% Sand, 25% fines. Lithology of clasts: Granodiorite
0.5 - 4	GC		Clayey Gravel with Sand: reddish brown, dry, mod. plasticity, strong HCl reaction, some roots. USCS: 30% > 1.5 inch, 50% gravel, 35% Sand, 15% fines. Lithology of clasts: Primarily Limestone to 3 feet, mixed Limestone/Granodiorite below 3 feet.

TEST PIT LOG: SR-TP-3

Client: Chino Mines Company
Project: Star Rock Stockpile
Project No.: 113-92700
Location: Chino Mine near Res 17
NAD 27: **N:** 3630589 **E:** 0771490

Date: 12/29/2010

Lithology:

Depth	*USCS*	*USDA*	*Description*
0 - 0.5 ft.	SM	Sandy Loam	Silty Sand with Gravel: 5YR 4/2 (dark reddish gray), dry, mod. plasticity, strong HCl reaction, moderately dense roots. USCS: 10% > 1.5 inch, 20% gravel, 55% Sand, 25% fines. Lithology of clasts: Granodiorite
0.5 - 4	GC		Clayey Gravel with Sand: grayish to reddish brown, moist, mod. plasticity, strong HCl reaction. USCS: 10% > 1.5 inch, 50% gravel, 30% Sand, 20% fines. Slightly cemented clayes, no soil in matrix as in previous pits. Lithology of clasts: Primarily Limestone (>90%) with minor Granodiorite and Shale.

APPENDIX C

LABORATORY ANALYTICAL RESULTS
JANUARY 2011

ENERGY LABORATORIES
www.energylab.com
Analytical Excellence Since 1952

Helena, MT 877-472-0711 • Billings, MT 800-735-4489 • Casper, WY 888-235-0515
Gillette, WY 866-686-7175 • Rapid City, SD 888-672-1225 • College Station, TX 888-690-2218

ANALYTICAL SUMMARY REPORT

January 13, 2011

Golder Associates Inc
5200 Pasadena NE Ste C
Albuquerque, NM 87113

Workorder No.: B11010187

Project Name: Star Rock Stockpile 103-92704

Energy Laboratories Inc Billings MT received the following 3 samples for Golder Associates Inc on 1/4/2011 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
B11010187-001	SR-TP-1	12/29/10 11:30	01/04/11	Solid	Conductivity pH, Saturated Paste Particle Size Analysis Saturation Percentage Texture
B11010187-002	SR-TP-2	12/29/10 12:20	01/04/11	Solid	Same As Above
B11010187-003	SR-TP-3	12/29/10 12:45	01/04/11	Solid	Same As Above

This report was prepared by Energy Laboratories, Inc., 1120 S 27th St., Billings, MT 59101. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By:

Sonya Mallett

LABORATORY ANALYTICAL REPORT
Prepared by Billings, MT Branch

Client: Golder Associates Inc
Project: Star Rock Stockpile 103-92704
Workorder: B11010187

Report Date: 01/13/11
Date Received: 01/04/11

	Analysis	Sand	Silt	Clay	Texture	pH, Sat Paste	Cond_ Paste	Saturation
	Units	%	%	%		s_u_	mmhos/cm	%
Sample ID	Client Sample ID	Results	Results	Results	Results	Results	Results	Results
B11010187-001	SR-TP-1	50	29	21	L	7.20	1.10	31.3
B11010187-002	SR-TP-2	58	26	16	SL	7.30	2.45	25.8
B11010187-003	SR-TP-3	56	28	16	SL	7.30	1.60	26.5

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Gillette, WY 866-686-7175 • Rapid City, SD 888-672-1225 • College Station, TX 888-690-2218

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Project: Star Rock Stockpile 103-92704
Lab ID: B11010187-001
Client Sample ID: SR-TP-1

Report Date: 01/13/11
Collection Date: 12/29/10 11:30
DateReceived: 01/04/11
Matrix: Solid

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Sand	50	%		1		ASA15-5	01/11/11 16:09 / srm
Silt	29	%		1		ASA15-5	01/11/11 16:09 / srm
Clay	21	%		1		ASA15-5	01/11/11 16:09 / srm
Texture	L					ASA15-5	01/11/11 16:09 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)							
SATURATED PASTE							
pH, sat. paste	7.20	s.u.		0.10		ASAM10-3.2	01/11/11 10:39 / srm
Conductivity, sat. paste	1.10	mmhos/cm		0.01		ASA10-3	01/11/11 10:39 / srm
Saturation	31.3	%		0.1		USDA27a	01/13/11 08:05 / srm

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Project: Star Rock Stockpile 103-92704
Lab ID: B11010187-002
Client Sample ID: SR-TP-2

Report Date: 01/13/11
Collection Date: 12/29/10 12:20
DateReceived: 01/04/11
Matrix: Solid

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Sand	58	%		1		ASA15-5	01/11/11 16:09 / srm
Silt	26	%		1		ASA15-5	01/11/11 16:09 / srm
Clay	16	%		1		ASA15-5	01/11/11 16:09 / srm
Texture	SL					ASA15-5	01/11/11 16:09 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)							
SATURATED PASTE							
pH, sat. paste	7.30	s.u.		0.10		ASAM10-3.2	01/11/11 10:39 / srm
Conductivity, sat. paste	2.45	mmhos/cm		0.01		ASA10-3	01/11/11 10:39 / srm
Saturation	25.8	%		0.1		USDA27a	01/13/11 08:05 / srm

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Project: Star Rock Stockpile 103-92704
Lab ID: B11010187-003
Client Sample ID: SR-TP-3

Report Date: 01/13/11
Collection Date: 12/29/10 12:45
DateReceived: 01/04/11
Matrix: Solid

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Sand	56	%		1		ASA15-5	01/11/11 16:09 / srm
Silt	28	%		1		ASA15-5	01/11/11 16:09 / srm
Clay	16	%		1		ASA15-5	01/11/11 16:09 / srm
Texture	SL					ASA15-5	01/11/11 16:09 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)							
SATURATED PASTE							
pH, sat. paste	7.30	s.u.		0.10		ASAM10-3.2	01/11/11 10:39 / srm
Conductivity, sat. paste	1.60	mmhos/cm		0.01		ASA10-3	01/11/11 10:39 / srm
Saturation	26.5	%		0.1		USDA27a	01/13/11 08:05 / srm

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Report Date: 01/13/11
Project: Star Rock Stockpile 103-92704
Work Order: B11010187

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASA10-3									Batch: R159744
Sample ID: B11010187-003A DUP	Sample Duplicate				Run: MISC-SOIL_110111A				01/11/11 10:39
Conductivity, sat. paste	1.63	mmhos/cm	0.010				1.9	30	
Sample ID: LCS-1101111039	Laboratory Control Sample				Run: MISC-SOIL_110111A				01/11/11 10:39
Conductivity, sat. paste	8.42	mmhos/cm	0.010	96	50	150			

Qualifiers:

RL - Analyte reporting limit

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Project: Star Rock Stockpile 103-92704

Report Date: 01/13/11
Work Order: B11010187

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASA15-5									Batch: R159762
Sample ID: B11010187-001A DUP	*Sample Duplicate*				Run: MISC-SOIL_110111B			01/11/11 16:09	
Sand	51	%	1.0				2.0	40	
Silt	29	%	1.0				0.0	40	
Clay	20	%	1.0				4.9	40	
Sample ID: LCS-1101111609	Laboratory Control Sample				Run: MISC-SOIL_110111B			01/11/11 16:09	
Sand	38	%	1.0	93	50	150			
Silt	37	%	1.0	106	50	150			
Clay	25	%	1.0	104	50	150			

Qualifiers:

RL - Analyte reporting limit

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Project: Star Rock Stockpile 103-92704

Report Date: 01/13/11
Work Order: B11010187

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: ASAM10-3.2									Batch: R159744
Sample ID: B11010187-003A DUP	Sample Duplicate				Run: MISC-SOIL_110111A				01/11/11 10:39
pH, sat paste	7.30	s.u.	0.10				0.0	10	
Sample ID: LCS-1101111039	Laboratory Control Sample				Run: MISC-SOIL_110111A				01/11/11 10:39
pH, sat paste	7.10	s.u.	0.10	100	90	110			

Qualifiers:

RL - Analyte reporting limit

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Golder Associates Inc
Project: Star Rock Stockpile 103-92704

Report Date: 01/13/11
Work Order: B11010187

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: USDA27a									Batch: R159835
Sample ID: B10122032-001A DUP	Sample Duplicate				Run: MISC-SOIL_110113A				01/13/11 08:05
Saturation	22.4	%	0.10				0.9	30	
Sample ID: B11010187-003A DUP	Sample Duplicate				Run: MISC-SOIL_110113A				01/13/11 08:05
Saturation	25.8	%	0.10				2.7	30	
Sample ID: LCS-1101130805	Laboratory Control Sample				Run: MISC-SOIL_110113A				01/13/11 08:05
Saturation	37.8	%	0.10	100	50	150			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

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Gillette, WY 866-686-7175 • Rapid City, SD 888-672-1225 • College Station, TX 888-690-2218

Workorder Receipt Checklist

B11010187

Golder Associates Inc

Login completed by: Darwin C. Miller
Date Received: 1/4/2011

Reviewed by: BL2000\gmccartney
Received by: grc

Reviewed Date: 1/5/2011
Carrier name: FedEx

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shipping container/cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature:	8.4°C On Ice		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	Not Applicable ☑

Contact and Corrective Action Comments:

None

Chain of Custody and Analytical Request Record

Page ____ of ____

PLEASE PRINT- Provide as much information as possible.

Company Name: Golder Associates	Project Name, PWS, Permit, Etc.: Star Rock Stockpile 103-92704	Sample Origin: State: New Mexico	EPA/State Compliance: Yes ☒ No ☐
Report Mail Address: 301 W College Ave, Suite 8	Contact Name: Jen Pepe — Phone/Fax: 575-388-0118	Email: jpepe@golder.com	Sampler: (Please Print) Jen Pepe
Invoice Address: Same	Invoice Contact & Phone: Same	Purchase Order:	Quote/Bottle Order:

Special Report/Formats – ELI must be notified prior to sample submittal for the following:

- ☐ DW
- ☐ GSA
- ☐ POTW/WWTP
- ☐ State: _____
- ☐ Other: _____
- ☐ A2LA
- ☒ EDD/EDT (Electronic Data) Format: Excel
- ☐ LEVEL IV
- ☐ NELAC

Number of Containers
Sample Type: A W S V B O
Air Water Soils/Solids Vegetation Biossay Other

ANALYSES REQUESTED

SEE ATTACHED

Normal Turnaround (TAT)

RUSH

Contact ELI prior to RUSH sample submittal for charges and scheduling – See Instruction Page

Comments:

Samples shipped on ice for possible chemistry tests. Please store for future tests.

ABA only if pH is less than 5

Shipped by: Fed Ex Express

Cooler ID(s):

Receipt Temp: 8.4 °C

On ice: (Yes) No

Custody Seal Y (N) / Intact Y N / Signature Match Y N

	SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	SEE ATTACHED	Normal Turnaround (TAT)	RUSH	Comments	LABORATORY USE ONLY
1	SR-TP-1	12/29/10	11:30	Soil	X				B101187-001
2	SR-TP-2	12/29/10	12:20	Soil	X				-002
3	SR-TP-3	12/29/10	12:45	Soil	X				-003
4	SR-TP-DUP	12/29/10	12:45	Soil	.			Hold sample for possible future tests	-004
5									
6									
7									
8									
9									
10									

Custody Record MUST be Signed

	Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
	Jen Pepe	1/3/10				
	Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
				Received by Laboratory:	Date/Time:	Signature:
	Sample Disposal: Return to Client: _____	Lab Disposal: ✓		Monica R Carver	1.4.11	0910

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.

Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links.

Analysis	Source-Method
Saturated Paste pH	SLS, Method 2 and 21a
Electrical Conductivity	SLS, Method 3a and 4b
Saturation percentage	SLS, Method 27a
Particle Size Distribution	Gee and Bauder (1986)
Acid-Base Account with Total Sulfur, Sulfer Forms, and Neutralization Potential	Modified Sobek

Note:

*** Only if pH <5**